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STUDIES OF THE POLLEN GRAINS OF PLANTS NATIVE TO VICTORIA, AUSTRALIA

1. GOODENIACEAE (INCLUDING *BRUNONIA*)

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Abstract

The pollen morphology of the Victorian members of the Goodeniaceae is described, and it is shown that three different types of pollen grain can be distinguished. Variation in the pollen within a species, and particularly that variation which is associated with differences in locality and treatment, is examined. The extent to which members of the family can be identified from their pollen grains and the relation of pollen type to classification are discussed.

Introduction

With the increasing interest in pollen analysis in Australia, the need for detailed studies of the pollen grains of Australian plants is becoming more and more evident. There is a certain amount of information already available in the few works which deal specifically with the pollen morphology of Australian groups, in general works on pollen morphology, in comparative studies of recent Australian pollen grains and their relation to Tertiary ones and in papers on the life history and cytogenetics of Australian plants. However, this is only a beginning, and the success of pollen analysis when applied to Australian deposits (particularly those of Quaternary age, which have been almost completely neglected) will depend on the availability of much more information about the pollen of Australian plants. The lack of a widespread and varied wind-pollinated tree flora (which has been the basis of pollen analysis in the northern hemisphere) means that attention will have to be given to plants which do not come into this category, as even one or two pollen grains of a particular type in a deposit may be of importance. Furthermore, the fact that many families and genera are widely distributed throughout Australia indicates that the identification of pollen grains at a specific level may be particularly desirable.

An attempt is now being made to determine the extent to which Victorian plants can be identified by detailed studies of their pollen grains. It is intended to deal first of all with families which are strongly represented in Australia but are less common in, or absent from, the northern hemisphere, as these are usually the ones about which least information is available. The first family to be treated is the Goodeniaceae, where most genera and all but a few species are Australian endemics.

Species examined

The pollen of *Brunonia* has been included in these studies in spite of the fact that many systematists place this genus in a separate, monotypic family, the

Brunoniaceae. However, as indicated by Erdtman (1952), there are many points of similarity between the pollen of *Brunonia* and that of some members of the Goodeniaceae, and hence it is desirable to consider them together, irrespective of the true systematic position of *Brunonia*.

Most of the names used for the plants from which pollen was obtained are those given by Ewart (1930). However, *Dampiera purpurea R.Br.* replaces *D. brownii* F.v.M. (Court 1957), and certain members of staff (cited below) of the National Herbarium, Melbourne, have kindly permitted me to use the following information regarding species which were not recorded by Ewart:

Goodenia affinis De Vriese. Black (1948-57) noted that *G. Primulacea* Schlechtd. occurs in W. Victoria, but, according to J. H. Willis and R. V. Smith, the correct name for the plant in question (as it occurs in Victoria) is *G. affinis*.

Goodenia lunata J. M. Black. The record of the extension of this species into Victoria is authenticated by R. V. Smith.

Scaevola depauperata R.Br. The record of the extension of this species into Victoria is authenticated by J. H. Willis.

The full list of the species from which pollen was obtained and of the localities from which they were derived is given in Table 1. The list is comprised only of the species known to occur naturally in Victoria, and all such species are included. Pollen of each species was obtained from plants growing in one or more Victorian localities, and in a few cases plants from other states are also represented.

Terms and methods

Unless otherwise stated, the terms used in the following descriptions are as defined by Erdtman (1952). As a matter of convenience, the polar diameter of the pollen grains is referred to as the length and the equatorial diameter as the width It seems desirable to have a method of indicating the exact position of the pollen grain when seen in equatorial view, and the terms which are used to refer to the orientation of the grain with respect to the colpi (in a typical tricolporate grain). Front view is used for grains which have a single colpus lying in the centre of the grain towards the observer (e.g. *Goodenia barbata* Pl. XIV, fig. 17-18), back view for those in which two colpi are uppermost (e.g. *G. barbata* Pl. XIV, fig. 13-15) and side view for those in which one colpus is in optical section when the middle of the grain is in focus (e.g. *Velleia paradoxa* Pl. XVII, fig. 5-7). The polar area index is the measurement used by Iversen and Troels-Smith (1950) and Faegri and Iversen (1950) to express the latitude reached by the ends of the colpi on the surface of the grain; it is the ratio of distance between the adjacent ends of two colpi to the width of the pollen grain. The width of the os (the inner part of the compound aperture) is the diameter at right angles to the polar axis of the pollen grain.

The figures given in Table 1 are not all based on the same number of measurements. The pollen of *Goodenia ovata* from Mt Dandenong was used to find out whether 25 measurements would give satisfactory values for the mean length (P), width (E) and length/width ratio (P/E). The means of 25 and 50 pollen grains were as follows:

	P	E	P/E
25 grains	$37{\cdot}5\mu$	$33{\cdot}5\mu$	$1{\cdot}1$
50 grains	$37{\cdot}8\mu$	$34{\cdot}0\mu$	$1{\cdot}1$

This confirmed the view that 25 measurements would be adequate for these dimensions, and this number was used for all examples. However, as the range is obviously of great importance if any attempt is made to use the size and shape in identifying the pollen grains, the measurements of any particularly large, small, wide or narrow grains seen when examining the slides were included in the records of the range of the length, width and length/width ratio. Other measurements are either less important or were more difficult to make, and the figures for the mean of the polar area index, the width of the exine and the width of the ora are based on only 10 measurements in each case. The exact outline of the ora could not be distinguished in the pollen grains of *Dampiera*, and hence measurements of the width of the ora are omitted for this genus.

With the exception of figures for the width of the exine, measurements were made to the nearest μ. Measurements of the width of the exine were estimated to the nearest $\frac{1}{4}\mu$; they are probably not completely accurate to this degree, but such estimates are necessary in order to obtain figures for the range.

The methods used in making preparations of pollen grains are essentially those described by Erdtman (1952). Stamens from fresh or herbarium material were placed in glacial acetic acid and squashed with a glass rod to release the pollen. The pollen was then acetolysed, and part of it mounted in unstained glycerine jelly and part in glycerine jelly stained with safranin. Wherever possible, some of the material which had been acetolysed was retained and subsequntly chlorinated, and mention of chlorinated grains in this paper always refers to grains which were acetolysed prior to chlorination. The chlorinated grains were mounted separately, in stained and unstained glycerine jelly, and were not mixed with those which had only been acetolysed. Measurements of acetolysed pollen grains and of chlorinated grains were recorded separately. With few exceptions, half the number of measurements in each group were taken from stained and half from unstained grains (or, in the case of 25 measurements, 12 and 13 respectively). These were recorded separately, but were put together when means, etc. were calculated.

Pollen of the Victorian species

In addition to a general account of the pollen of the Goodeniaceae (and *Brunonia*), Erdtman (1952) gives a list of previous publications dealing with the pollen of this family, and Selling (1947) gives some additional references as well as an account of the early work on this subject. As the present work covers only the pollen of Victorian species, and deals with them in greater detail than has hitherto been given, it is not considered necessary to discuss previous descriptions of the pollen of the family or to review the literature further.

The pollen grains of the Victorian species are typically tricolporate, with colpi which do not meet at either pole. Table 2 shows the species in which grains with two, four or more colpi and parasyncolpate grains have been observed but, with the exception of those relating to *Dampiera rosmarinifolia* from the Wimmera, all other figures and discussion refer only to tricolporate grains which are not parasyncolpate. This restriction has been made because parasyncolpate grains and those without three colpi form only a small percentage of the total number of pollen grains, and in some ways are not directly comparable with what are regarded as typical grains. The parasyncolpate grains (e.g. *Goodenia lanata* Pl. XVII, fig. 18) are similar in size and shape to those without joined colpi, but they do not have a polar area index in the normal sense, although it is common to find that the colpi bifurcate and join only at one pole of a given grain, remaining separate at

the other. In pollen with two colpi (e.g. *Scaevola pallida* Pl. XV, fig. 9-10), the colpi are joined to form a ring passing through the poles (so that there is no polar area index), and owing to this arrangement the shape is somewhat different from that of tricolporate grains. Furthermore, ora may be absent from the pollen with two colpi. In grains with four or more colpi, the grains may be more or less normal in size and shape, although the colpi on opposite sides of the grain are often at an angle to one another (e.g. *Goodenia lunata* Pl. XIII, fig. 17). In many cases, grains with four or more colpi are of irregular shape and may be up to twice as large as the tricolporate ones of the same species. The difference between grains of *Goodenia subintegra* with three and four colpi is shown in Pl. XVII, fig. 11-12.

The pollen of *Dampiera rosmarinifolia* from the Wimmera is exceptional in that 4-colporate grains predominate, 80% of the pollen being of this type. Because of this, 4-colporate grains were measured when pollen of this species from the Wimmera was being examined. However, the 4-colporate condition is not a character of the species as a whole, as grains with four colpi were not observed in the pollen from Bendigo and only a few were found in the Lake Albacutya material. Work on polyploid races of a number of species has shown that their pollen tends to be larger and to have more apertures than the diploids, and hence it may be suggested tentatively that the material of *D. rosmarinifolia* from the Wimmera represents a polyploid.

Examination of the other morphological features of the pollen of the Victorian Goodeniaceae shows that the pollen can be divided into three distinct types, which will now be described separately. Measurements of the pollen of individual species are given in Table 1, and details of other morphological features shown in Table 2. Illustrations of one or two species representing each genus are given in the plates. These show front, back, side and polar views of *Brunonia australis* (Pl. XIII, fig. 1-16), *Dampiera stricta* (Pl. XIV, fig. 1-9), a large and a small example of *Goodenia* (*G. barbata* Pl. XIV, fig. 13-20; *G. heteromera* Pl. XV, fig. 1-8) and *Scaevola* (*S. ramosissima* Pl. XVI, fig. 1-8, 10-12; *S. pallida* Pl. XV, fig. 9-19), *Selliera radicans* (Pl. XVI, fig. 9, 13-22) and *Velleia paradoxa* (Pl. XVII, fig 1-10). Photographs of grains of other species demonstrate specific points discussed in the text. Where illustrations are cited in brackets after mention of a particular feature, they refer only to the fact that the example shows the feature in question, and are not intended to be exhaustive.

Goodenia-type

This type of pollen is found in all the Victorian species of *Goodenia, Scaevola, Selliera* and *Velleia*.

SIZE: The length of the pollen grains in this group shows a wide range and the width a somewhat smaller one. In acetolysed grains, the length is from 24μ in several species from Victorian localities (22μ was recorded for *Goodenia humilis* from Tasmania) to 59μ (*Scaevola calendulacea*), and the width is from 21μ in *Goodenia humilis* from Victoria (20μ from Tasmania) to 51μ (*Scaevola depauperata*). In chlorinated grains, the length is from 25μ (*Goodenia amplexans* and *Velleia montana*) to 71μ (*Scaevola depauperata*) and the width from 21μ (*Goodenia humilis*) to 47μ (*Scaevola depauperata*).

SHAPE: In polar view, the pollen grains are most commonly more or less hexagonal in outline (*Goodenia heteromera* Pl. XV, fig. 2; *Velleia connata* Pl. XV, fig. 26). The sides which do not include the colpi may be straight (*Goodenia robusta*

Pl. XIII, fig. 18; *Velleia connata* Pl. XV, fig. 26), slightly curved (*Velleia paradoxa* Pl. XVII, fig. 9; *Selliera radicans* Pl. XVI, fig. 9) or more strongly curved, giving an approximately circular (*Velleia montana* Pl. XV, fig. 21) or almost lobed shape (*Goodenia pusilliflora* Pl. XV, fig. 28).

In equatorial view, the grains are from approximately circular to elliptical. The length may be greater or less than the width, and the grains range from suboblate to perprolate, with a length/width ratio of from 0·8 (in acetolysed grains of a number of species) to 2·1 (chlorinated grains of *Scaevola aemula*). In front and back view, the curve of the sides is usually quite smooth (*Goodenia barbata* Pl. XIV, fig. 13), but in some cases there is a bulge at the equator in the position of the os (*Scaevola ramosissima* Pl. XVI, fig. 7). In side view, the side which includes the colpus may show a smooth curve (*Goodenia barbata* Pl. XIV, fig. 19) or a slight bulge at the equator (*Velleia montana* Pl. XV, fig. 30), or it may be angular in outline (*Velleia connata* Pl. XVII, fig. 17).

Exine: The exine is divided into an inner, apparently homogeneous nexine and an outer sexine consisting of a thin, homogeneous ectosexine and an endosexine of branched or unbranched baculae (*Goodenia ovata* Pl. XVII, fig. 14). Thus the sexine is tegillate. The pattern, which forms a conspicuous feature in most grains (particularly when seen in polar view), seems to be due to the trunks of the baculae. The pattern at low focus (where it is most clearly defined) consists of dark spots or patches separated by light areas (*Selliera radicans* Pl. XVI, fig. 13); at a higher focus, the pattern is less distinct and the position of the light and dark parts is reversed (*Selliera radicans* Pl. XVI, fig. 14).

For purposes of comparing the pattern with that of pollen grains in other families, it is desirable to have a descriptive term which is independent of the structure, but this does not seem to be available. Erdtman (1952) illustrates sexines of this type and labels them tegillate-baculate or tegillate-ramibaculate (with the baculae unbranched and branched respectively), while Iversen and Troels-Smith (1950) and Faegri and Iversen (1950) either use or indicate the term intra-baculate for them. However, these terms are related to structure and not only to pattern. It is proposed to use the word mottled to describe the pattern (i.e. the appearance of the pollen grain, without reference to the structure of the exine), and to use this as a general term to cover a pattern which, when most clearly defined, consists of dark patches or spots surrounded by lighter areas.

The pattern is not equally coarse over the whole surface of the individual grain. The colpi are bounded by a zone in which the pattern is much finer than elsewhere (*Velleia paradoxa* Pl. XVII, fig. 3; *Scaevola pallida* Pl. XV, fig. 15). This is particularly conspicuous in polar view, and gives a characteristic appearance to the grains in this group. The pattern over the ora is also extremely fine (*Velleia paradoxa* Pl. XVII, fig. 3). The pattern at the poles is usually coarser than at the equator between the fine zones bounding the colpi (*Goodenia elongata* Pl. XVII, fig. 20), but the degree to which this character is developed varies with the species.

The pattern at the poles and at the equator between the colpi varies both within a species and between species. In order to describe this variation, a series of grades of pattern has been established. The main grades which can be distinguished are fine, medium and coarse, but these are connected by intermediates (fine/medium and medium/coarse) and the pattern may also be very coarse. The grades apply only to the pollen of the family as discussed in this paper. Examples of the grades which are illustrated in the plates are:

Fine—
Goodenia barbata (Pl. XIV, fig. 16)
G. elongata (Pl. XVII, fig. 20)
G. heteromera (Pl. XV, fig. 6)

Fine/medium—
Goodenia amplexans (Pl. XIII, fig. 21)
G. barbata (Pl. XIV, fig. 15)
G. gracilis (Pl. XIV, fig. 26)
G. paniculata (Pl. XIV, fig. 24)
Scaevola ramosissima (Pl. XVI, fig. 8)
Velleia paradoxa (Pl. XVII, fig. 8)

Medium—
Goodenia barbata (Pl. XIV, fig. 20)
G. pusilliflora (Pl. XV, fig. 29)
Scaevola pallida (Pl. XV, fig. 17)
S. ramosissima (Pl. XVI, fig. 6)
Velleia montana (Pl. XV, fig. 22)
V. paradoxa (Pl. XVII, fig. 10)

Medium/coarse—
Goodenia barbata (Pl. XIV, fig. 22)
G. gracilis (Pl. XIV, fig. 28)
G. heteromera (Pl. XV, fig. 3)
G. ovata (Pl. XV, fig. 25)
Selliera radicans (Pl. XVI, fig. 16)

Coarse—
Goodenia ovata (Pl. XV, fig. 23)
G. robusta (Pl. XIII, fig. 19)
Scaevola pallida (Pl. XV, fig. 19)
S. ramosissima (Pl. XVI, fig. 11)
Selliera radicans (Pl. XVI, fig. 13)
Velleia connata (Pl. XV, fig. 27)

Very coarse—
Scaevola aemula (Pl. XVII, fig. 15)

The pattern discussed above is the most obvious one. In some species a second, very fine and very uniform pattern can be discerned (using an objective of 45:1, N.A. 0·65) at a slightly higher level. This pattern (which will be called the outer pattern to distinguish it from the one already discussed) consists of minute dark spots surrounded by light areas (*Scaevola aemula* Pl. XVII, fig. 16; *S. ramosissima* Pl. XVI, fig. 12). It is not clear whether the outer pattern is due to the branches of the baculae or whether it is an ectosexinous feature, but the fact that the dark spots are light (if very indistinct) at a higher focus suggests that they may represent the branches of the baculae.

There is either a gap or a very thin place in the nexine at the ora, but, apart from this, the nexine is of approximately even thickness in all parts of a given pollen grain. On the other hand, the thickness of the sexine varies considerably in different parts of the grain, this variation being paralleled by changes in the coarseness of the pattern. Each colpus is bounded by a zone in which the sexine is thin, and it is considerably thicker in the areas between these zones (*Goodenia barbata* Pl. XIV, fig. 21; *Selliera radicans* Pl. XVI, fig. 9). Furthermore, the sexine between the thin zones thickens from the equator towards the poles in most species. This is usually apparent even in side view (*Goodenia heteromera* Pl. XV, fig. 7), but is more conspicuous in front or back view (*G. subintegra* Pl. XVII, fig. 12) because the sexine is very thin over the ora. The effect may be emphasized by a flattening of the nexine at the poles (*G. barbata* Pl. XIV, fig. 13), and in a few instances the thickenings at the poles stand out as distinct bumps (*G. paniculata* Pl. XIV, fig. 23) which appear to correspond with the structure termed a polar cap by Selling (1947). The extent to which the sexine is thickened at the poles is rather variable. When seen in side view, the grains vary from those showing little or no thickening at the poles (*Velleia montana* Pl. XV, fig. 30) to those where the thickening is very considerable (e.g. *Scaevola aemula*, where the sexine is up to 6μ thick at the poles). Even when seen in front or back view, the thickening may be inconspicuous or absent (as is the case with many grains of *Goodenia pusilliflora*), but in these positions it can be seen in some grains of all species from all localities.

In some pollen grains the sexine is thickened at the poles and tapers gradually towards the equator, but in others there is a second area of thickening below the poles (*Scaevola ramosissima* Pl. XVI, fig. 3; *Goodenia pinnatifida* Pl. XV, fig. 20).

It lies approximately mid-way between the poles and the equator. This thickening may be only very slight (*Scaevola calendulacea* Pl. XVII, fig. 13), but in some examples (as seen in the illustration of *S. ramosissima* just cited) it is so great that, when seen in side view, the side of the grain which does not include the colpus is concave. The thickening occurs chiefly in the areas between the colpi, and is not shown, or is less evident, in front or back view.

APERTURES: The pollen grains are typically colporate, with three long colpi equally spaced around the equator and with a transversely placed os in the centre of each colpus. However, as previously pointed out, there may be two, four or more colpi and, although the ends of the colpi are not usually joined, the grains can be syncolpate or parasyncolpate. The colpi are in the form of grooves from which the sexine is absent, the floor of the colpus being formed by the nexine (*Goodenia barbata* Pl. XIV, fig. 21). When seen in polar view, the nexine beneath the colpus varies from more or less flat or slightly convex (*G. barbata* Pl. XIV, fig. 21) to strongly concave (*Scaevola ramosissima* Pl. XVI, fig. 10). There is some suggestion that the shape of the nexine in this position may be characteristic of particular species, but it also seems to be related to the degree of expansion of the grains, and hence has not been included in the tables.

The ora are formed by a gap or a very thin place in the nexine (*Selliera radicans* Pl. XVI, fig. 22; *Velleia paradoxa* Pl. XVII, fig. 6) but are covered by the sexine. Their ends may be rounded or pointed; both these shapes may be found in the one preparation. Although ora are probably always present (except in grains with only two colpi), it is not uncommon to find that their outline is indistinct, so that it is difficult to distinguish their shape or to measure their width.

Brunonia-type

This type of pollen, which is basically similar to the *Goodenia*-type, is found only in *Brunonia australis* (at least, as far as Victorian members of the Goodeniaceae are concerned).

SIZE: The pollen grains are relatively large. Acetolysed grains range from 43μ (36μ in material from Western Australia) to 56μ in length and from 32μ (30μ for W.A.) to 44μ in width. In the case of chlorinated grains, the range in length is from 50μ (39μ for W.A.) to 67μ and the range in width is the same as that for acetolysed grains.

SHAPE: In polar view, the shape is somewhat variable, ranging from more or less triangular, with the apertures in the middle of the sides of the triangle (Pl. XIII, fig. 1), through slightly lobed (Pl. XIII, fig. 3) to approximately circular (Pl. XIII, fig. 5). In equatorial view, the grains are elliptical, ranging from prolate sphaeroidal to prolate and having a length/width ratio of from 1·1 (1·0 for W.A.) to 1·7 (1·8 for W.A.). The curve of the sides is smooth, without bulges at the equator. In side view, there is often a tendency for the side which does not include the colpus to be more strongly convex than the opposite side, so that the grain has a lop-sided appearance.

EXINE AND APERTURES: The exine shows the same structure as that found in the *Goodenia*-type, although the baculae, particularly in parts of the grain other than the poles, are sometimes less distinct (Pl. XIII, fig. 8). The pattern is mottled. It varies from fine (Pl. XIII, fig. 11) to medium (Pl. XIII, fig. 10) at the equator between the colpi, and from fine to very coarse at the poles. The examples of polar views which are illustrated show patterns which are medium

(Pl. XIII, fig. 4), medium/coarse (Pl. XIII, fig. 6) and very coarse (Pl. XIII, fig. 2). In a given grain, the pattern is finest over the ora and in the vicinity of the colpi (Pl. XIII, fig. 6, 16), and is usually coarser at the poles than at the equator. An outer pattern (Pl. XIII, fig. 12) was discernable only in the material from Kingston.

The sexine is thickened, usually quite considerably, at the poles, and sometimes this thickening forms a fairly distinct polar cap (Pl. XIII, fig. 8). There may be a slight sexinous thickening below the poles, but this is usually absent.

The apertures are of the same general structure as those found in the *Goodenia*-type, and consist of long, equatorially placed colpi (usually three), each with a transverse os (Pl. XIII, fig. 7). The colpi are formed by a gap in the sexine, the ora by a gap in the nexine. The only important difference between the *Goodenia*-type and the *Brunonia*-type lies in the structure of the sexine in the vicinity of the colpi. Instead of tapering to a very thin band at the edges of the colpi, as in the *Goodenia*-type, the sexine forms two ridges on either side of each colpus in the *Brunonia*-type (Pl. XIII, fig. 1, 5, 6, 15). The inner of these ridges is always clearly evident, but the outer one may be inconspicuous.

Dampiera-type

The only Victorian member of the Goodeniaceae to show this type of pollen (which is rather different from the *Goodenia*-type and *Brunonia*-type) is *Dampiera*.

Size: The grains are small. In acetolysed grains, the length ranges from 12μ (*D. marifolia*) to 21μ (*D. rosmarinifolia* and *D. stricta*) and the width from 13μ (*D. marifolia* and *D. stricta*) to 23μ (*D. rosmarinifolia* and *D. stricta*). In chlorinated grains, the length ranges from 13μ (*D. lanceolata* and *D. marifolia*) to 26μ (*D. rosmarinifolia*) and the width from 15μ (*D. marifolia* and *D. stricta*) to 23μ (*D. purpurea* and *D. rosmarinifolia*). In the special case of the 4-colporate grains of *D. rosmarinifolia* from the Wimmera, the acetolysed grains may be slightly larger than those of the other examples (to 22μ long and 25μ wide).

Shape: In polar view, the pollen grains are from more or less triangular (*D. purpurea* Pl. XIV, fig. 11), with straight or slightly convex sides, to circular (*D. stricta* Pl. XIV, fig. 3) or slightly lobed. The 4-colporate grains of *D. rosmarinifolia* from the Wimmera (Pl. XIV, fig. 10) are square or rectangular.

In equatorial view, the pollen grains are elliptical or circular, ranging from oblate to subprolate and having a length/width ratio of from 0·7 (acetolysed grains of several species) to 1·3 (acetolysed grains of *D. rosmarinifolia*, chlorinated grains of this species and *D. stricta*). In front and back view, the sides are smoothly curved or more or less angular. In side view, the side including the colpus may be curved but is more usually angular (*D. stricta* Pl. XIV, fig. 5).

Exine: The exine is thin. It is divided into nexine and sexine, both of which appear to be homogeneous; there is no indication of the individual baculae which characterize the *Goodenia*-type and *Brunonia*-type pollen.

The pollen grains all show a pattern, although it is so fine that, at least in the case of *D. marifolia*, it can only be distinguished with the aid of an oil immersion objective. It consists of minute dark spots surrounded by lighter areas (*D. stricta* Pl. XIV, fig. 9), but the exact structure responsible for the pattern cannot be determined. In comparison with the grades of pattern found in the *Goodenia*-type and *Brunonia*-type, the pattern in *Dampiera* can be classed as very fine. There is

little or no difference between the pattern at the poles and at the equator between the colpi, but it becomes even finer or absent along the margins of the colpi.

The nexine is of even thickness wherever it occurs in a given grain. The sexine is also more or less uniform over most of the grain, but it tapers to an extremely thin zone around each colpus (*D. purpurea* Pl. XIV, fig. 11).

APERTURES: The grains are colporate. They usually have three equatorially placed apertures, but the material of *D. rosmarinifolia* from the Wimmera shows a predominance of grains with four apertures (Pl. XIV, fig. 10). The apertures differ from those of the *Goodenia*-type and *Brunonia*-type in that the os is apparently little or no wider than the colpus instead of being an elongated structure. The os is marked by a break or thin place in the nexine (*D. stricta* Pl. XIV, fig. 8) and, although the interruption of the colpus at the equator is quite clear (*D. stricta* Pl. XIV, fig. 2), the exact outline of the os is indistinguishable and the width cannot be measured. The colpus itself is formed by a gap in the sexine.

Variation in the pollen grains

Before discussing the use of the characters of the pollen grains, as given in the tables and described in the text, in the identification of the plants concerned, it is important to consider the variation in these characters in each species, as it is this variation which determines the limits within which descriptions and measurements can be regarded as accurate and constant. The variation to be assessed is that which occurs in the pollen of any species from one locality and from more than one locality, and also which is induced by different treatments when preparing the pollen for examination. The features which will be discussed are the size, shape and pattern of the pollen grains. These are probably the most important features, they may be regarded as representative of the other group given in Tables 1 and 2, and size and shape are the only characters for which a relatively large number of measurements is available. As a matter of convenience, the word 'example' in the following discussion is used to indicate pollen of one species from one locality treated by one method, so that, for instance, the acetolysed and chlorinated pollen of a species from two localities would constitute four examples.

VARIATION IN A SPECIES FROM ONE LOCALITY

The variation in the pollen, whether acetolysed or chlorinated, of a given species from a single locality tends to be appreciable. The range of the length may be up to 23μ (*Brunonia australis* from Lake Austin, W.A.), and the average range for the 123 examples is approximately 9μ. The range of the width is not quite so great; the maximum is 14μ (*Scaevola aemula*) and the average range is 7μ. The range in shape (as measured by P/E) is usually moderate to large, the maximum range for P/E being 0·7 (which occurs in a number of species) the average being approximately 0·4.

Except in the case of the pollen of *Dampiera*, there is usually an appreciable variation in the pattern (particularly at the poles) of the pollen of each example. Excluding *Dampiera* and ignoring treatment (which does not seem to affect the pattern), 62 examples were available for examination, and of these only four show a single grade of pattern at the poles, while 14 show three grades. The pattern is less variable at the equator, as half the examples show only one grade and only three examples show three grades; *Selliera radicans* is exceptional in that it may show four grades in a single example. The variation in the pattern at the equator

in one example is shown for *Goodenia barbata* in Plate XIV, where fig. 16 shows a fine pattern, fig. 15 fine/medium and fig. 20 medium. The variation at the poles is also illustrated in Plate XIV, where fig. 26 shows a fine/medium pattern and fig. 28 a medium/coarse pattern in the pollen of *G. gracilis*. Although it is not common, there may be an appreciable variation between the pattern at one pole of a pollen grain and that of the other pole; an example of this is seen in the case of *G. ovata*, where one pole of a grain may be medium/coarse (Pl. XV, fig. 25) and the other pole coarse (Pl. XV, fig. 23).

Preparations of the pollen of each species from each locality were made up without reference to whether one or more plants were used as a source of the pollen. In the case of *G. ovata* from Tidal River, the pollen from two different plants was kept separate to find out whether there were any differences between their pollen grains. When the features from Tidal River (1) and (2) are compared, it is seen that they are almost identical, the only difference of any magnitude being the wider variation in polar pattern of the pollen of Tidal River (2).

Variation with Locality

On the whole, there is good agreement between the pollen of a species from one locality and that of the same species from other localities. Acetolysed pollen from each of 21 species was prepared from two or more localities, and these show an average difference in the mean length of each species from different localities (measured as the greatest difference when more than two localities are concerned) of 3μ. The lower and upper ends of the range of the length also show a difference of 3μ. The difference in mean width averages 2μ, the lower end of the range in width 2μ and the upper end of the range 3μ. The difference in the mean and both ends of the range of P/E averages 0·1. Figures for chlorinated grains (where only 14 species are concerned) are the same as the ones for acetolysed pollen, except for the fact that the average difference in the upper end of the range in length is 4μ.

It might be expected that comparisons between Victorian localities would show less variation in the pollen of a species than when Victorian and interstate localities are compared. This is true of the length, where the differences in the mean, the lower and upper ends of the range all average 2μ for Victorian localities and 4μ when Victorian localities are compared with interstate ones, but the width and P/E seem unaffected by the position of the localities concerned.

It must be pointed out that, although there is not in general a great deal of variation in the pollen grains of a species from two or more localities, in some cases the variation (particularly in the length) may be considerable. Thus the mean length of acetolysed grains of *Brunonia australis* is only 40μ in material from Lake Austin, W.A., compared with 52μ for the pollen from Lake Hindmarsh, and the complete range in length of chlorinated grains from these sources is 28μ. As far as other species are concerned, comparison of localities within Victoria shows that the difference in mean length may be up to 6μ and in either end of the range in length up to 9μ (both shown in chlorinated grains of *Scaevola hookeri*).

The possible variation in the polar pattern of a given species with locality can be summed up by comparing the smallest range in pattern recorded from any of the localities with the complete range in pattern (i.e. when all localities are taken into consideration). The same technique can be used for the pattern at the equator. When both the polar and equatorial patterns are studied, it is found that the complete range of the pattern is the same as the smallest range in 31% of the cases, it is greater than the smallest range by one grade in 45%, by two grades in 17%

and by three or four grades in 7% of the cases where comparison is possible. In essence, this means that the pattern usually shows only a small variation or no variation at all with locality, but that in a few instances the variation may be considerable. The greatest variation is seen in the polar pattern of *Brunonia australis,* where the complete range is of six grades (from fine to very coarse) compared with the smallest range of two grades.

Variation with Treatment

The fact that certain characters (particularly the size) of pollen grains are influenced by the treatment to which they are subjected is well known, and the pollen of the Goodeniaceae is no exception. In the present case, the pattern appears to be unaffected by treatment, and hence size and shape are the only characters which will be considered further.

When differences between pollen which has been acetolysed only and that which has also been chlorinated are examined, it is found that the length of the chlorinated grains is in general greater than that of the acetolysed ones. The 55 examples in which the two treatments can be compared show an average increase of 4·3μ, or 13%, in the mean length with chlorination, the lower end of the range is increased by an average of 2·9μ (9·5%) and the upper end by 6·5μ (17%). Unfortunately, the length of chlorinated grains cannot be predicted accurately from that of acetolysed ones, as the increase in length with chlorination is not uniform, and indeed does not always take place; the mean length is unchanged in 6% of the examples, and the increase, when shown, varies from 3-34% of the mean. The change in the lower end of the range varies from 0-12μ (or 0-31%) and the upper end from 0-17μ (0-42%). The increase in length with chlorination is usually accompanied by an increase in the width of the exine at the poles. The increase in exine width averages 9% (and may be up to 29%) of the mean width, but it involves an average change of only 0·3μ and is in no real sense responsible for the increase in length of the whole pollen grain.

The effect of chlorination on the width of the pollen grains is considerably less than on the length, and it is much more variable in direction. There is a general increase in the width, but it is small (an average increase in the mean of 0·4μ, or 2%), and only 49% of the examples show an increase in the mean width, 36% remaining unchanged and 15% showing a decrease. The change in the mean varies from a decrease of 5μ or 11% to an increase of 4μ or 14%. The effect on the range of the width is similar to the changes noted in the mean. On the whole, it appears that the differences between the width of acetolysed and chlorinated pollen grains are so small and erratic that they may be disregarded.

The points made above suggest that chlorinated grains will tend to be longer in relation to their width than acetolysed ones, and this is borne out by the figures for P/E. The mean P/E for chlorinated grains averages 0·1 (12·5%) more than that of acetolysed ones, and an increase is shown by 80% of the examples, 18% remaining unchanged and 2% showing a decrease. The change varies from a decrease of 0·1 (or 8%) to an increase of 0·4 (or 36%). Figures for the range show the same general trend.

As the figures for stained and unstained grains were recorded separately for 102 examples, the effect of staining on the size and shape of the pollen grains could also be investigated. Although there is an overall decrease in the mean length, width and P/E with staining and a decrease is more common than an increase, the effect is so small that it is of no consequence. The only appreciable

difference noted for any of the figures was in the case of *Goodenia grandiflora*, where the mean length of the unstained grains was more than 5μ greater than that of the stained ones.

The identification of genera and species from the pollen

As seen in the preceding section, the characters of the pollen of a species are reasonably constant, so that they can be used as a basis for the identification of taxa should only the pollen be available. However, due allowance must be made for the variation that does exist, particularly in view of the fact that such variation may be considerable in some instances. Figures and observations for the pollen of a species which has been prepared from one locality cannot be regarded as necessarily representing the complete range of the characters to which they refer, and it is desirable that pollen grains from different sources should be treated by the same methods before they are compared. When attempting to separate pollen on the basis of size, the range is more important than the mean, and the width, which is less variable, may be more useful than the length. Separation on any basis, and particularly on the basis of size or pattern, can only be made when the pollen grains compared differ appreciably.

As far as the identification of genera is concerned, there is no difficulty in separating pollen grains of *Dampiera* and *Brunonia* from one another and from the group of genera included in the *Goodenia*-type. The main differences between the three types may be summed up as follows. Pollen of the *Goodenia*-type is characterised by an exine with distinct baculae, colpi with an elongated, transversely placed os at the equator and by a zone around each colpus in which the sexine is very thin. The pollen of *Brunonia* is like that of the *Goodenia*-type, but there are two sexinous ridges along each margin of the colpus. *Dampiera* pollen has no evident baculae, it lacks an elongated os and sexinous ridges, and the pattern is finer than that of the other Victorian members of the Goodeniaceae.

As there is only one species of *Brunonia*, the pollen can be identified at a specific level. *Dampiera* pollen appears to be very uniform, and *D. marifolia* seems to be the only species with pollen which is at all distinctive. In this pollen, the pattern is finer and the size and distance between the ends of the colpi are usually smaller than is the case with the other species examined. Pollen of *D. marifolia* could be identified under favourable circumstances, and in certain cases a tentative identification of other species might be made—e.g. a chlorinated pollen grain of this type in which the polar exine measured $2{\cdot}3\mu$ would probably be *D. purpurea*. However, it is clear that the identification of species in this genus would be the exception rather than the rule, particularly if only a few grains were available.

Within the *Goodenia*-type, there is no feature or group of features which can be used to separate the genera, and it is not possible to draw up a key to identify the species. However, it is believed that, by taking into consideration all the features recorded in the tables, identification of a genus, a group of species or an individual species may be possible in some circumstances. For instance, a pollen grain of the *Goodenia*-type which was more than 65μ long, with strong sexinous thickenings at and below the poles, would be referable to *Scaevola*, while one which exceeded 60μ in length but lacked conspicuous sexinous thickenings below the poles would probably be *Scaevola calendulacea*.

The most convenient method of using the characters described and measured in this paper in the identification of pollen would be to transfer the records to a

punch-card system. This has not been done here because it seems probable that most palynologists have their own systems, but it is hoped that sufficient information has been given to satisfy the requirements of such systems.

It is not possible at present to discuss the separation of the pollen grains of Victorian members of the Goodeniaceae from those of a similar type which may occur in other families. This matter will be dealt with as descriptions of the pollen of other families are accumulated.

The relation of pollen morphology to classification and phylogeny

In his recent work on the Goodeniaceae, Carolin (1959) uses the floral structure and anatomy as a basis for the division of the family into four subfamilial groups, the *Brunonia* group (*Brunonia* only), the *Dampiera* group (*Dampiera* and *Anthotium*), the *Leschenaultia* group (*Leschenaultia* only) and the *Goodenia* group (all other genera). The findings of Jackson (1958) regarding the chromosome numbers in Tasmanian representatives of the family are in line with this classification. The results of the present study of the pollen morphology of the Victorian species also fit in with the division into three of the four groups mentioned, while the tetrads of *Leschenaultia,* with poroid apertures (Erdtman 1952), obviously support the suggestion that this Western Australian genus should be placed in a separate group.

Carolin, in agreeing with those who retain *Brunonia* within the Goodeniaceae, states that, although it does stand somewhat apart, the generalized structure conforms fairly well with that of the rest of the family. As pointed out by Erdtman (1952), this is also true of the pollen. As far as the Victorian species are concerned, the pollen of *Dampiera* differs more from that of the four genera in the *Goodenia* group than does *Brunonia* pollen.

Carolin suggests that, in the light of his investigations, the scheme of affinities put forward by Krause (1912) must be modified, and Carolin produces his own phylogenetic scheme for members of the family. The present studies cannot do a great deal towards assisting in the solution of phylogenetic problems, but they do support Carolin's view that there are four main lines of development from an ancestral type rather than Krause's six lines leading from *Goodenia*. They are also in agreement with the way in which he places *Dampiera* in an almost completely separate line of development rather than, like Krause, deriving it from *Goodenia* through *Scaevola.*

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Tables

See pages following.

Table 1

Dimensions of the Pollen Grains of Victorian Species of the Family Goodeniaceae

Localities are in Victoria unless otherwise specified. Each set of three figures shows the mean (in bold type) and the range. All direct measurements are in μ. The terms used are explained at greater length in the text.

P = Length (polar diameter) of pollen grain; E = Width (equatorial diameter) of pollen grain; P/E = Length/width ratio of pollen grain; PM = Distance between the ends of adjacent colpi; PAI = Polar area index; WO = Width of ora; WPX = Width of the exine at the pole.

(A) = Acetolysed pollen grains; (C) = Acetolysed and chlorinated pollen grains.

Species	P	E	P/E	PM	PAI	WO	WPX
BRUNONIA							
B. australis Sm.							
(A) Kingston	43–**50**–56	32–**39**–43	1·1–**1·3**–1·5	11–**13**–14	0·2–**0·3**–0·4	12–**16**–18	5·0–**5·1**–5·7
L. Hindmarsh	45–**52**–56	32–**37**–44	1·1–**1·4**–1·6	12–**16**–21	0·2–**0·4**–0·5	13–**16**–18	6·3–**6·8**–7·7
L. Austin, W.A.	36–**40**–45	30–**34**–36	1·0–**1·2**–1·4	10–**10**–12	0·2–**0·3**–0·4	12–**14**–18	5·0–**5·6**–6·4
Perth, W.A.	41–**45**–49	32–**35**–39	1·1–**1·3**–1·5	8–**10**–11	0·2–**0·3**–0·3	11–**13**–16	5·0–**5·7**–6·4
(C) L. Hindmarsh	50–**58**–67	32–**38**–44	1·3–**1·5**–1·7	13–**16**–21	0·3–**0·4**–0·5	12–**16**–18	6·3–**7·4**–8·9
L. Austin, W.A.	39–**51**–62	30–**34**–37	1·1–**1·5**–1·8	7–**11**–13	0·2–**0·3**–0·4	12–**14**–18	6·3–**7·1**–7·7
Perth, W.A.	44–**50**–56	32–**36**–41	1·1–**1·4**–1·6	8–**10**–12	0·2–**0·3**–0·3	11–**14**–16	5·0–**5·9**–6·4
DAMPIERA							
D. lanceolata A. Cunn.							
(A) L. Hattah	13–**16**–18	15–**18**–21	0·7–**0·9**–1·0	2–**3**–6	0·1–**0·2**–0·3		1·0–**1·3**–1·8
(C) L. Hattah	13–**17**–19	16–**18**–21	0·8–**1·0**–1·1	2–**3**–6	0·1–**0·2**–0·3		1·0–**1·4**–1·8
D. marifolia Bth.							
(A) Nhill	12–**14**–16	13–**16**–18	0·7–**0·9**–1·0	2–**3**–4	0·1–**0·2**–0·3		1·0–**1·2**–1·6
(C) Nhill	13–**15**–18	15–**16**–20	0·8–**0·9**–1·1	2–**3**–4	0·1–**0·2**–0·3		1·0–**1·3**–1·6
D. purpurea R.Br.							
(A) Snowy R.	15–**16**–18	17–**19**–21	0·8–**0·9**–1·0	3–**5**–6	0·2–**0·3**–0·4		1·2–**1·4**–1·8
(C) Snowy R.	16–**20**–23	17–**19**–23	0·8–**1·1**–1·2	3–**5**–7	0·2–**0·3**–0·3		1·2–**1·8**–2·3
D. rosmarinifolia Schlech.							
(A) Bendigo	15–**18**–21	15–**18**–23	0·8–**1·0**–1·3	2–**4**–6	0·1–**0·2**–0·4		1·0–**1·3**–1·8
L. Albacutya	16–**18**–20	15–**19**–21	0·8–**0·9**–1·1	2–**4**–6	0·1–**0·2**–0·3		1·0–**1·3**–1·8
Wimmera (4 colpi)	17–**20**–22	17–**21**–25	0·8–**1·0**–1·1	7–**9**–10	0·4–**0·5**–0·6		1·2–**1·5**–1·8
(C) Bendigo	17–**20**–26	16–**18**–21	0·9–**1·1**–1·3	3–**4**–6	0·2–**0·2**–0·3		1·0–**1·4**–1·8
L. Albacutya	17–**19**–23	17–**19**–23	0·9–**1·0**–1·3	2–**4**–6	0·1–**0·2**–0·3		1·2–**1·5**–1·8
Wimmera (4 colpi)	19–**22**–26	17–**20**–23	1·0–**1·1**–1·3	7–**9**–11	0·3–**0·4**–0·5		1·2–**1·5**–1·8

DAMPIERA—continued							
D. stricta R.Br.							
(A) Tambo Crossing	15–18–21	17–20–23	0·7–0·9–1·0	3– 6– 7	0·2–0·3–0·4		1·0–1·3–1·6
Gembrook	13–15–21	13–17–21	0·8–0·9–1·0	3– 4– 6	0·2–0·2–0·3		1·0–1·2–1·6
(C) Gembrook	15–18–23	15–18–22	0·8–1·0–1·3	3– 4– 6	0·1–0·2–0·3		1·2–1·4–1·8
GOODENIA							
G. affinis De Vr.							
(A) Dimboola	27–31–36	24–26–31	1·0–1·2–1·4	6– 7– 9	0·2–0·3–0·4	10–12–14	2·2–2·5–2·8
(C) Dimboola	30–33–39	24–28–33	1·0–1·2–1·5	6– 8– 9	0·2–0·3–0·4	10–12–14	2·2–2·6–2·8
G. amplexans F.v.M.							
(A) Shire of Dimboola	25–29–33	24–26–28	1·0–1·1–1·3	5– 6– 8	0·1–0·2–0·3	10–12–14	2·2–2·5–2·8
(C) Shire of Dimboola	25–32–39	22–26–31	1·0–1·3–1·5	5– 6– 8	0·1–0·2–0·3	10–12–14	2·2–2·5–2·8
G. barbata R.Br.							
(A) E. Victoria	39–43–46	31–34–37	1·1–1·3–1·4	10–13–14	0·3–0·4–0·4	12–16–18	3·5–4·1–4·6
Mt Finlay, N.S.W.	38–40–45	30–33–39	1·0–1·2–1·4	8–10–14	0·2–0·3–0·4	15–17–18	3·0–4·1–4·6
(C) E. Victoria	43–48–54	30–33–37	1·3–1·5–1·6	10–13–16	0·2–0·3–0·4	12–16–18	3·8–4·4–4·9
Mt Finlay, N.S.W.	40–45–51	30–33–36	1·2–1·4–1·6	8–10–12	0·2–0·3–0·4	12–15–18	3·2–3·7–4·4
G. elongata Labill.							
(A) Wangaratta	34–38–45	30–33–39	0·9–1·1–1·3	7– 8– 9	0·2–0·2–0·3	15–16–18	2·5–2·8–3·1
(C) Wangaratta	36–41–49	27–31–36	1·0–1·3–1·5	7– 8– 9	0·1–0·2–0·3	12–17–19	2·5–3·1–3·3
G. geniculata R.Br.							
(A) Steiglitz	25–31–36	22–26–28	1·0–1·2–1·4	6– 8– 9	0·2–0·3–0·3	10–11–13	2·2–2·4–2·5
Melbourne	30–32–37	24–27–31	1·0–1·2–1·4	7– 8–10	0·2–0·3–0·4	10–13–14	2·2–2·6–2·8
(C) Melbourne	32–35–42	26–29–33	1·1–1·2–1·4	6– 9–11	0·2–0·3–0·4	12–14–16	2·5–2·7–3·1
G. glauca F.v.M.							
(A) Shire of Borung	27–31–36	22–25–30	1·0–1·2–1·4	6– 7– 8	0·2–0·3–0·4	10–11–13	2·5–2·7–2·8
(C) Shire of Borung	27–34–41	22–26–31	1·0–1·3–1·5	6– 7– 8	0·2–0·3–0·3	10–12–13	2·5–2·7–3·1
G. gracilis R.Br.							
(A) Shire of Dimboola	27–31–36	22–26–28	1·0–1·2–1·5	5– 7– 9	0·2–0·2–0·3	10–11–13	2·2–2·6–2·8
(C) Shire of Dimboola	30–34–37	25–27–32	1·0–1·3–1·4	6– 7– 8	0·2–0·2–0·3	10–11–13	2·2–2·6–2·8
G. grandiflora Sims							
(A) Melb. Botanic Gardens	32–36–44	29–34–39	0·8–1·1–1·4	7– 8–11	0·2–0·2–0·3	12–15–18	2·5–2·8–3·1
(C) Melb. Botanic Gardens	35–43–50	27–33–39	0·9–1·3–1·5	7– 9–11	0·2–0·3–0·3	13–16–18	2·5–3·1–3·9

TABLE 1 (*continued*)

Species	P	E	P/E	PM	PAI	WO	WPX
GOODENIA—continued							
G. hederacea Sm.							
(A) Mt Nelse	24–27–31	22–28–32	0·8–1·0–1·2	5– 6– 8	0·1–0·2–0·3	11–13–14	2·0–2·4–2·6
(C) Mt Nelse	30–34–41	29–32–39	1·0–1·1–1·2	7– 8–11	0·2–0·3–0·4	11–13–16	2·2–2·8–3·1
G. heteromera F.v.M.							
(A) Minyip	24–26–28	22–23–26	1·0–1·1–1·3	6– 7– 9	0·2–0·3–0·4	10–12–14	2·5–2·8–3·1
(C) Minyip	26–30–35	20–23–26	1·1–1·3–1·5	6– 8– 9	0·2–0·3–0·4	10–12–13	2·7–3·2–3·9
G. humilis R.Br.							
(A) Grampians	26–29–33	21–23–26	1·0–1·3–1·5	5– 6– 7	0·1–0·2–0·3	7–10–13	2·0–2·4–2·6
Orbost	25–27–31	21–24–30	1·0–1·1–1·3	5– 6– 8	0·2–0·2–0·3	10–12–14	2·2–2·4–2·6
L. St Clair, Tas.	22–25–31	20–23–28	0·8–1·1–1·3	5– 6– 8	0·1–0·2–0·4	10–12–13	2·2–2·5–2·8
(C) Grampians	26–30–33	21–24–28	1·0–1·3–1·5	5– 6– 7	0·1–0·2–0·3	8–10–12	2·2–2·5–2·6
Orbost	27–31–36	21–24–28	1·1–1·3–1·7	5– 7– 8	0·2–0·3–0·3	10–11–13	2·5–2·6–2·8
L. St Clair, Tas.	25–30–37	21–25–31	1·0–1·2–1·5	5– 7–11	0·2–0·3–0·5	10–12–14	2·5–2·7–3·1
G. lanata R.Br.							
(A) Ballarat	40–43–49	29–33–37	1·2–1·3–1·5	7– 8–11	0·2–0·2–0·3	15–17–21	2·5–2·8–3·3
Lilydale	36–41–45	30–33–36	1·0–1·2–1·4	7–10–11	0·2–0·3–0·4	15–17–19	2·5–2·6–3·1
(C) Ballarat	40–48–55	30–33–40	1·2–1·4–1·6	7– 9–11	0·2–0·3–0·3	12–16–20	2·7–3·1–3·3
Lilydale	39–46–51	29–34–39	1·1–1·4–1·5	7–10–11	0·2–0·3–0·4	15–16–18	2·5–3·1–4·1
G. lunata J. M. Black							
(A) Shire of Borung	28–32–35	25–28–31	1·0–1·1–1·3	7– 9–11	0·2–0·3–0·4	10–13–16	2·2–2·5–2·8
(C) Shire of Borung	31–35–42	26–30–33	1·0–1·2–1·3	7– 9–11	0·2–0·3–0·4	10–13–16	2·2–2·6–2·8
G. ovata Sm.							
(A) Mt Dandenong	33–38–42	29–34–39	1·0–1·1–1·4	12–14–17	0·3–0·4–0·5	12–15–18	2·5–2·6–3·1
Tidal R. (1)	30–34–39	27–31–33	1·0–1·1–1·3	7– 8–11	0·2–0·3–0·4	12–15–18	3·0–3·5–3·9
Tidal R. (2)	31–35–41	29–32–33	0·9–1·1–1·3	7– 8–11	0·2–0·3–0·4	12–15–16	2·5–3·3–3·9
Waterloo Bay	34–38–41	25–29–31	1·1–1·3–1·5	7– 8–11	0·2–0·3–0·4	12–14–16	3·0–3·9–4·6
Mt Oberon	27–35–39	25–31–36	0·9–1·1–1·4	7– 8– 9	0·2–0·2–0·3	12–14–16	2·5–2·9–3·3
(C) Mt Oberon	30–40–46	26–32–37	1·0–1·3–1·7	7– 8–11	0·2–0·2–0·3	12–14–16	2·7–3·4–4·4
G. paniculata Sm.							
(A) Bruthen	26–29–31	25–29–32	0·9–1·0–1·1	6– 7– 8	0·2–0·2–0·3	11–13–14	2·2–2·6–3·1
(C) Bruthen	34–36–41	25–28–32	1·1–1·3–1·5	7– 9–11	0·2–0·3–0·4	11–13–16	2·5–3·0–3·3

GOODENIA—continued								
G. pinnatifida Schlech.								
(A)	St Albans	26–29–32	25–29–31	0·9–1·0–1·1	5– 7– 8	0·1–0·2–0·3	10–13–16	2·5–2·9–3·3
	Lower Lockton	27–30–32	22–24–27	1·0–1·2–1·4	6– 7– 8	0·1–0·3–0·3	10–12–16	2·5–2·7–2·8
(C)	Lower Lockton	27–30–35	22–25–28	1·0–1·2–1·3	5– 7– 8	0·2–0·3–0·4	10–13–16	2·5–2·8–3·1
G. pusilliflora F.v.M.								
(A)	Nhill	30–34–39	24–29–31	1·0–1·2–1·4	8–10–11	0·2–0·3–0·4	10–11–12	2·5–3·0–3·6
	Dimboola district	29–32–35	24–26–28	1·0–1·2–1·4	8– 9–11	0·2–0·3–0·4	6– 8–11	2·2–2·4–2·6
	Mildura	27–30–33	25–27–30	0·9–1·1–1·2	7–10–13	0·2–0·4–0·5	7–10–12	2·2–2·3–2·6
(C)	Dimboola district	30–32–39	25–27–31	1·0–1·2–1·3	7– 9–12	0·2–0·3–0·5	6– 8– 9	2·2–2·4–2·6
	Mildura	30–33–36	24–28–31	1·0–1·2–1·4	7– 9–11	0·2–0·3–0·4	9–10–12	2·2–2·5–2·8
	Shire of Borung	32–36–40	26–29–32	1·1–1·3–1·4	7– 9–11	0·2–0·3–0·4	10–11–12	2·2–2·7–3·1
G. robusta Krause								
(A)	Wimmera	30–33–36	25–28–31	1·0–1·2–1·4	7– 9–11	0·2–0·3–0·4	10–12–14	2·5–2·7–3·1
(C)	Wimmera	32–36–41	26–30–35	1·0–1·2–1·4	8–10–11	0·2–0·3–0·4	10–13–16	2·5–2·8–3·1
G. stelligera R.Br.								
(A)	Cann R.	35–37–41	29–33–36	0·9–1·1–1·4	10–12–16	0·3–0·4–0·5	17–19–21	2·5–2·8–3·1
	Hastings R., N.S.W.	32–36–41	27–32–36	0·9–1·1–1·3	8– 9–11	0·2–0·3–0·4	13–16–18	2·7–3·3–3·6
(C)	Cann R.	35–42–46	29–32–36	1·1–1·3–1·5	10–12–14	0·3–0·4–0·4	15–17–20	2·7–2·9–3·3
	Hastings R., N.S.W.	41–45–46	30–32–35	1·3–1·4–1·5	8– 9–11	0·2–0·3–0·3	11–15–18	3·2–3·5–3·9
G. subintegra F.v.M.								
(A)	Mildura	32–36–40	25–27–28	1·1–1·3–1·5	8– 9–11	0·2–0·3–0·4	13–17–18	2·7–3·0–3·3
	Booroorban, N.S.W.	30–34–37	25–29–33	0·9–1·2–1·4	6– 8–12	0·1–0·3–0·4	12–14–18	2·7–3·2–3·9
(C)	Mildura	32–36–42	25–29–33	1·1–1·2–1·4	8–10–12	0·2–0·4–0·5	15–17–18	2·7–3·2–3·6
	Booroorban, N.S.W.	32–35–41	26–30–35	1·0–1·2–1·4	6– 8–11	0·2–0·3–0·4	11–13–17	2·7–3·2–3·9
G. varia R.Br.								
(A)	Wedderburn district	32–36–40	29–31–35	1·0–1·2–1·3	7– 9–11	0·2–0·3–0·4	11–13–17	2·7–3·2–3·9
(C)	Wedderburn district	34–38–46	27–32–36	1·0–1·2–1·4	7– 8– 9	0·2–0·2–0·3	11–13–16	2·7–3·3–3·9
SCAEVOLA								
S. aemula R.Br.								
(A)	Wimmera	45–49–54	32–35–39	1·2–1·4–1·7	10–12–13	0·2–0·3–0·4	15–16–18	5·0–5·2–5·9
(C)	Wimmera	48–58–69	30–34–44	1·4–1·7–2·1	10–11–13	0·2–0·3–0·4	12–16–18	5·0–5·9–7·1
S. calendulacea Druce								
(A)	Port Fairy	48–52–59	32–37–41	1·2–1·4–1·6	7–10–13	0·1–0·2–0·3	13–16–18	3·2–4·3–5·1
(C)	Port Fairy	48–57–66	32–38–45	1·4–1·5–1·7	5–10–12	0·1–0·2–0·3	12–14–16	3·8–4·6–5·1

TABLE 1 (*continued*)

Species	P	E	P/E	PM	PAI	WO	WPX
SCAEVOLA—continued							
S. depauperata R.Br.							
(A) Mildura	45–50–54	40–47–51	0·9–1·1–1·3	7–11–14	0·1–0·2–0·4	17–21–23	4·0–4·7–5·1
(C) Mildura	55–61–71	38–42–47	1·2–1·5–1·6	10–11–13	0·2–0·2–0·3	15–18–21	5·0–5·6–6·4
S. hookeri F.v.M.							
(A) Marlo	31–35–39	25–28–30	1·1–1·3–1·5	7– 8–10	0·2–0·3–0·4	10–11–13	2·5–2·9–3·1
Mt Nelse	33–35–38	30–32–33	1·0–1·1–1·3	7–10–11	0·2–0·3–0·4	12–14–16	3·0–3·8–4·6
(C) Marlo	38–41–45	25–29–33	1·3–1·4–1·6	7– 9–11	0·2–0·3–0·4	10–12–16	3·0–3·2–3·6
Mt Nelse	40–47–54	27–33–38	1·2–1·4–1·6	7–11–13	0·2–0·3–0·4	11–14–17	4·5–4·9–5·1
S. microcarpa Cav.							
(A) Portland	32–34–36	27–30–33	1·0–1·1–1·3	7– 8– 9	0·2–0·2–0·3	12–13–16	2·5–2·8–3·6
Airey's Inlet	26–29–33	24–26–28	1·0–1·1–1·3	6– 7– 8	0·2–0·3–0·3	10–12–14	2·2–2·6–2·8
(C) Airey's Inlet	30–34–40	22–26–30	1·0–1·3–1·5	6– 7– 8	0·2–0·3–0·3	11–13–16	2·5–2·9–3·1
S. pallida R.Br.							
(A) Portland	27–29–31	22–25–27	1·1–1·2–1·4	5– 7– 8	0·2–0·3–0·4	10–12–13	2·5–2·8–3·0
S. Victoria	27–30–36	25–27–29	1·0–1·1–1·3	5– 7– 8	0·2–0·3–0·3	10–12–13	2·5–2·9–3·3
(C) S. Victoria	30–34–44	25–27–32	1·0–1·3–1·5	6– 8– 9	0·2–0·3–0·4	10–12–13	2·5–2·8–3·3
S. ramosissima (Sm.) Kraus.							
(A) Mt Drummer	42–45–49	30–36–41	1·1–1·2–1·5	7–12–14	0·2–0·3–0·4	17–20–23	4·5–5·0–5·4
Orbost	45–48–52	31–36–40	1·1–1·3–1·6	10–11–13	0·2–0·3–0·4	15–17–21	4·5–4·8–5·1
(C) Mt Drummer	50–53–61	30–34–42	1·3–1·6–1·8	7– 9–11	0·1–0·2–0·4	15–17–21	5·0–5·2–5·9
Orbost	48–53–61	32–36–45	1·2–1·5–1·7	10–12–13	0·2–0·3–0·4	12–15–18	4·0–4·5–5·1
S. spinescens R.Br.							
(A) Mildura	32–37–44	26–29–32	1·1–1·3–1·5	7– 9–11	0·2–0·3–0·4	12–14–16	3·5–4·1–4·6
Mt Squires, W.A.	38–42–47	30–32–36	1·2–1·3–1·5	10–12–13	0·3–0·4–0·5	12–16–20	3·2–3·9–4·6
(C) Mildura	36–40–47	27–29–33	1·2–1·4–1·5	7– 9–11	0·2–0·3–0·4	11–13–16	4·3–4·6–4·9
Mt Squires, W.A.	40–48–55	30–32–37	1·3–1·5–1·7	11–12–14	0·3–0·4–0·4	11–14–17	3·2–4·2–4·9
SELLIERA							
S. radicans Cav.							
(A) Frankston	32–36–39	27–30–33	1·0–1·2–1·5	7– 9–11	0·2–0·3–0·4	10–12–16	2·5–2·8–3·1
Wimmera R.	31–37–42	24–27–31	1·2–1·4–1·5	6– 8–11	0·2–0·3–0·3	10–13–16	2·5–3·2–3·9
(C) Frankston	32–42–46	27–30–35	1·0–1·4–1·7	7– 9–11	0·2–0·3–0·4	10–12–14	2·5–3·0–3·3
Wimmera R.	32–39–46	25–28–33	1·3–1·4–1·5	7– 9–11	0·2–0·3–0·4	10–13–16	2·7–3·5–3·9

VELLEIA								
V. connata F.v.M.								
(A)	Kattyoong	27–32–35	25–28–31	1·0–1·1–1·3	7– 8– 9	0·2–0·3–0·4	9–10–12	3·0–3·6–4·1
	Hamilton Downs, N.T.	27–28–31	29–31–33	0·8–0·9–1·0	7– 8– 8	0·2–0·3–0·3	11–13–14	3·0–3·4–3·9
(C)	Kattyoong	32–35–41	25–28–33	1·0–1·3–1·4	7– 8–11	0·2–0·3–0·4	10–12–14	3·5–4·0–4·6
	Hamilton Downs, N.T.	31–34–40	30–33–39	0·9–1·1–1·3	7– 8– 9	0·2–0·2–0·3	11–14–16	3·2–3·9–4·6
V. montana Hk.f.								
(A)	Bogong High Plains	24–27–32	22–26–30	0·9–1·0–1·2	5– 7–11	0·2–0·3–0·4	10–11–13	2·2–2·5–2·8
	Snowy R.	25–27–31	22–26–28	0·9–1·0–1·2	7– 8– 9	0·2–0·3–0·4	10–13–14	2·2–2·6–3·1
(C)	Bogong High Plains	25–29–39	24–26–30	1·0–1·1–1·3	5– 7–11	0·1–0·3–0·4	10–11–13	2·2–2·6–2·8
	Snowy R.	27–32–41	25–27–31	1·0–1·2–1·3	7– 9–11	0·2–0·3–0·4	10–13–16	2·5–2·8–3·1
V. paradoxa R.Br.								
(A)	St Albans	30–34–41	27–32–36	0·9–1·1–1·4	7– 8–11	0·2–0·3–0·4	15–16–18	2·5–2·8–3·1
	Donald	35–40–44	29–32–36	1·0–1·2–1·5	6– 8–11	0·1–0·2–0·3	11–13–16	2·7–2·9–3·3
(C)	Donald	39–44–51	30–33–39	1·0–1·3–1·5	7– 8– 9	0·2–0·2–0·3	10–13–16	2·5–2·9–3·1

Table 2

Certain details of the Shape, Apertures and Exine of Victorian Species of the Family Goodeniaceae

The terms used are explained at greater length in the text. Eq. Bul. = Bulges at the equator when seen in front or back view; Pol. > Eq. = Pattern coarser at the poles than at the equator.

+ = present or positive; × = developed to a slight extent; − = absent or negative.

Shape in polar view (shapes are approximate): C = circular; H = hexagonal; L = slightly lobed; R = rectangular; S = square; T = triangular.

Grades of pattern (these are placed in order in the table, so that the most common grade is first): VF = very fine; F = fine; F/M = fine/medium; M = medium; M/C = medium/coarse; C = coarse; VC = very coarse.

Species	Shape		Colpi		Sexine			Pattern			
					Thickened						
	Polar View	Eq. Bul.	Number	Parasyncolpate	At Poles	Below Poles	Polar Cap	Grade at Poles	Pol. > Eq.	Grade at Equator	Outer Pattern visible
BRUNONIA											
B. australis											
Kingston	T,L	−	3	−	+	−	+ −	F,F/M	+ −	F	+
L. Hindmarsh	T	−	2,3,>3	−	+	− ×	+ −	C,VC,M/C	+	M,F/M	−
L. Austin, W.A.	C,T	−	3	−	+	−	+ −	M/C,M	+	F	−
Perth, W.A.	T,C	−	3	−	+	−	+ −	M/C,M	+	F/M	−
DAMPIERA											
D. lanceolata											
L. Hattah	C,T	−	3,>3	− +	−	−	−	VF	−	VF	−
D. marifolia											
Nhill	T,C	−	3	−	−	−	−	VF	−	VF	−
D. purpurea											
Snowy R.	T,C	−	2,3	−	−	−	−	VF	−	VF	−
D. rosmarinifolia											
Bendigo	T,C,L	−	2,3	−	−	−	−	VF	−	VF	−
L. Albacutya	T	−	3,>3	− +	−	−	−	VF	−	VF	−
Wimmera (4 colpi)	R,S	−	3,>3	− +	−	−	−	VF	−	VF	−
D. stricta											
Tambo Crossing	T	−	3,>3	−	−	−	−	VF	−	VF	−
Gembrook	T,C	−	3,>3	− +	−	−	−	VF	−	VF	−
GOODENIA											
G. affinis											
Dimboola	H	− ×	3	− +	− ×	− ×	−	F/M,F	+ −	F	+
G. amplexans											
Shire of Dimboola	H	− ×	2,3	−	− ×	× +	−	F/M,F,M	+ −	F	+ −
G. barbata											
E. Victoria	H,C	−	3	− +	+	− ×	−	M/C,C	+	F/M,M	+ −
Mt Finlay, N.S.W.	H,C	−	2,3,>3	− +	+ ×	− ×	−	M/C,M	+ −	F/M	+ −
G. elongata											
Wangaratta	H	− ×	2,3,>3	− +	× +	× −	−	M/C,C	+	F	−
G. geniculata											
Steiglitz	H,L	−	3	−	×	×	−	M/C,C	+	F/M	−
Melbourne	H,C	−	3,>3	− +	− +	× −	−	F/M,M,M/C	+	F,F/M	+ −
G. glauca											
Shire of Borung	H,L,C	−	2,3,>3	− +	+	× +	−	C,M/C	+	F	+ −
G. gracilis											
Shire of Dimboola	H,C	− ×	2,3	− +	+ −	+ ×	− +	F/M,M,M/C	+	F	+ −
G. grandiflora											
Melbourne Botanic Gardens ..	H,C	− ×	3	− +	× −	− ×	−	F/M,M	+ −	F/M,M	+ −
G. hederacea											
Mt Nelse	H,L,C	− ×	2,3,>3	− +	× −	− +	−	M,F/M	+ −	F/M,F,M	+ −
G. heteromera											
Minyip	H	− ×	3	− +	+	− +	−	M/C,C	+	F	−
G. humilis											
Grampians	H	− ×	3,>3	− +	+ −	× −	−	F/M,M	+	F	+ −
Orbost	H	−	3,>3	−	+ −	× −	−	M,F/M	+	F/M,F	−
L. St Clair, Tas.	H	−	2,3,>3	−	+ −	× −	−	M,M/C,F/M	+	F	−
G. lanata											
Ballarat	H,C	−	2,3,>3	− +	×	+ ×	−	M,F/M	+	F/M,F,M	+ −
Lilydale	H,C	−	2,3,>3	− +	− +	+ −	−	M,F/M	+ −	F/M,F	+ −

TABLE 2 (*continued*)

Species	Shape		Colpi		Sexine			Pattern			
					Thickened						
	Polar view	Eq. Bul.	Number	Parasyncolpate	At Poles	Below Poles	Polar Cap	Grade at Poles	Pol. >Eq.	Grade at Equator	Outer Pattern visible
GOODENIA—continued											
G. lunata											
Shire of Borung	H,L	−	3,>3	−+	×−	−	−×	M/C,C,M	+	F	−
G. ovata											
Mt Dandenong	H	−	3	−	×−	−×	−	M/C,C	+	F/M	−
Tidal R. (1)	H	−	2,3	−	+×	×−	−	M/C	+	F/M,F	−
Tidal R. (2)	H	−	2,3	−	+×	×−	−	M/C,C,M	+	F/M,F	−
Waterloo Bay	H	−	3	−	+	×	−	C,M/C	+	F/M,F	−+
Mt Oberon	H	−	3	−	+−	×+	−	M/C,C,M	+	M,F/M,M/C	−
G. paniculata											
Bruthen	H	−	3	−	+−	×	−+	M/C,M,C	+	F	−+
G. pinnatifida											
St Albans	H	−	3	−	+×	+×	−+	M,M/C	+	F	+
Lower Lockton	H	−	3	−+	+	×−	−+	M,M/C	+	F	−
G. pusilliflora											
Nbill	C	−	3	−	+×	−	−	M,F/M	−	F/M	−
Dimboola district	C,L	−	3,>3	−+	−×	−	−	M,F/M	+−	F,F/M	−
Mildura	C,L	−	3,>3	−	−	×−	−	F,F/M	−	F/M,F	−+
Shire of Borung	C,L	−	3	−+	−+	×	−	F/M,M	+−	M	−
G. robusta											
Wimmera	H	−×	3	−+	×+	×−	−	C,M/C	+	F/M,M	+−
G. stelligera											
Cann R.	H	−	3	−+	+×	−×	−	M/C,M,C	+	F/M,F	−
Hastings R., N.S.W.	H,C	−×	3,>3	−+	+×	−×	−	M/C,C	+	F/M,F	+−
G. subintegra											
Mildura	H	−×	3,>3	−	+	×−	−	M/C	+	F	−
Booroorban, N.S.W.	H,L	−×	2,3,>3	−	+	+−	−	M/C,C	+	F	−
G. varia											
Wedderburn district	H	−	3,>3	−	+	−×	−	M	+	F/M	−
SCAEVOLA											
S. aemula											
Wimmera	H,C,L	+	3,>3	−	+	+	−	C,VC	+	F/M,M	−
S. calendulacea											
Port Fairy	H,C,L	−	2,3	−+	+	−×	−	M/C,C,M	+−	M,M/C	+−
S. depauperata											
Mildura	H,C,	−×	3,>3	−+	+	+	−+	M/C	+	F/M	−
S. hookeri											
Marlo	H,C	−×	3	−	+	−×	−	M,M/C	+	F/M,M	−
Mt Nelse	H,C	−	3,>3	−+	+	−×	−	M,M/C	+	F/M,M	−
S. microcarpa											
Portland	H,C	×	3	−	+	×	−	M/C,C	+	F	−
Airey's Inlet	H,C	−+	3,>3	−+	+	+	−	M/C,M	+	F,F/M	+−
S. pallida											
Portland	H,C	+	3	−	+	×	−	C,M/C	+	F/M,F	+
S. Victoria	H,C	×−	2,3	−	×+	+	−+	C,M/C	+−	F/M,M	−
S. ramosissima											
Mt Drummer	H	+	3	−	+	+	−+	C	+	F	+−
Orbost	H,C	+	3	−+	+	+	−	C,VC,M/C	+	M,F/M	−
S. spinescens											
Mildura	H,C	−×	2,3	−+	+	−+	−	C,M/C	+	F/M,F	−
Mt Squires, W.A.	H,L	−×	2,3,>3	−	+	−×	−	M,M/C	+	F/M	−
SELLIERA											
S. radicans											
Frankston	H	−	3,>3	−+	+×	−×	−	M,M/C,F/M	+−	M,F/M	+
Wimmera R.	H,C	−	3,>3	−+	+×	−×	−	C,VC	+	M/C,M,C,F/M	+−
VELLEIA											
V. connata											
Kattyoong	H	−	3,>3	−	+	×	−	C	+	F	−
Hamilton Downs, N.T.	H	−×	3,>3	−	+	−×	−	C,M/C	+	F/M	−
V. montana											
Bogong High Plains	H,C	−	2,3,>3	−	−×	×−	−	F/M,M	+−	F/M,F	−+
Snowy R.	H	−	2,3,>3	−	×	−×	−	M,M/C,F/M	+−	F/M,F	−
V. paradoxa											
St Albans	H,C	−	3,>3	−	×	−	−	M,M/C	+	F,F/M	+−
Donald	H	−	3,>3	−+	+×	−×	−	F/M,M	+	F	+−

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Explanation of Plates

All photographs, except the one shown in Pl. XVII, fig. 14, are magnified by approximately 650. The illustrations represent pollen grains which have been acetolysed and chlorinated unless they are specifically stated to have been acetolysed only. Where two or more photographs represent the same pollen grain, the successive figures show the grain at a progressively higher focus.

Plate XIII

Fig. 1-16—*Brunonia australis.*
- Fig. 1, 2—Lake Hindmarsh. Polar view. Acetolysed only.
- Fig. 3, 4—Kingston. Polar view. Acetolysed only.
- Fig. 5, 6—Lake Austin, W.A. Polar view. Acetolysed only.
- Fig. 7—Kingston. Front view. Acetolysed only.
- Fig. 8, 11, 12—Kingston. Back view. Acetolysed only.
- Fig. 9, 10—Lake Hindmarsh. Back view.
- Fig. 13—Lake Hindmarsh. Side view.
- Fig. 14-16—Lake Hindmarsh. Front view.

Fig. 17—*Goodenia lunata,* Shire of Borung. Equatorial view of grain with four colpi.
Fig. 18,19—*Goodenia robusta,* Wimmera. Polar view. Acetolysed only.
Fig. 20, 21—*Goodenia amplexans,* Dimboola. Polar view.

Plate XIV

Fig. 1-9—*Dampiera stricta,* Gembrook.
- Fig. 1, 2—Front view.
- Fig. 3, 4—Polar view.
- Fig. 5, 6—Side view.
- Fig. 7-9—Back view.

Fig. 10—*Dampiera rosmarinifolia,* Wimmera. Polar view of grain with four colpi.
Fig. 11, 12—*Dampiera purpurea,* Snowy R. Polar view.
Fig. 13-20—*Goodenia barbata,* E. Victoria.
- Fig. 13-15—Back view.
- Fig. 16—Back view.
- Fig. 17, 18—Front view.
- Fig. 19—Side view.
- Fig. 20—Back view.
- Fig. 21, 22—Polar view.

Fig. 23, 24—*Goodenia paniculata,* Bruthen. Back view.
Fig. 25, 26—*Goodenia gracilis,* Shire of Dimboola. Polar view.
Fig. 27, 28—*Goodenia gracilis,* Shire of Dimboola. Polar view.

PLATE XV

Fig. 1-8—*Goodenia heteromera*, Minyip.
Fig. 1, 6—Back view.
Fig. 2, 3—Polar view.
Fig. 4, 5—Front view.
Fig. 7, 8—Side view.
Fig. 9-19—*Scaevola pallida*, S. Victoria.
Fig. 9, 10—Equatorial view of grain with two colpi.
Fig. 11, 12—Side view.
Fig. 13—Side view.
Fig. 14, 15—Front view.
Fig. 16, 17—Back view.
Fig. 18, 19—Polar view.
Fig. 20—*Goodenia pinnatifida*, St. Albans. Side view. Acetolysed only.
Fig. 21, 22—*Velleia montana*, Bogong High Plains. Polar view. Acetolysed only.
Fig. 23-25—*Goodenia ovata*, Tidal R. Polar view. Acetolysed only.
Fig. 26, 27—*Velleia connata*, Kattyoong. Polar view.
Fig. 28, 29—*Goodenia pusilliflora*, Dimboola. Polar view.
Fig. 30—*Velleia montana*, Bogong High Plains. Side view. Acetolysed only.

PLATE XVI

Fig. 1-8, 10-12—*Scaevola ramosissima*.
Fig. 1, 2—Orbost. Front view.
Fig. 3—Mt Drummer. Side view.
Fig. 4—Orbost. Side view.
Fig. 5, 6—Orbost. Back view.
Fig. 7, 8, 12—Mt Drummer. Back view. Acetolysed only.
Fig. 10, 11—Orbost. Polar view.
Fig. 9, 13-22—*Selliera radicans*, Wimmera R.
Fig. 9, 13, 14—Polar view.
Fig. 15, 16—Back view.
Fig. 17, 21, 22—Side view.
Fig. 18-20—Front view.

PLATE XVII

Fig. 1-10—*Velleia paradoxa*, Donald.
Fig. 1-3—Front view.
Fig. 4, 8—Back view.
Fig. 5-7—Side view.
Fig. 9, 10—Polar view.
Fig. 11—*Goodenia subintegra*, Mildura. Equatorial view of grain with four colpi.
Fig. 12—*Goodenia subintegra*, Mildura. Back view.
Fig. 13—*Scaevola calendulacea*, Port Fairy. Side view.
Fig. 14—*Goodenia ovata*, Waterloo Bay. Part of section, more or less longitudinal. Acetolysed only. x *c*. 1300.
Fig. 15, 16—*Scaevola aemula*, Wimmera. Polar view.
Fig. 17—*Velleia connata*, Kattyoong. Side view.
Fig. 18—*Goodenia lanata*, Ballarat. Polar view.
Fig. 19, 20—*Goodenia elongata*, Wangaratta. Back view.